MODELING SEDIMENTATION ON THE CONTINENTAL MARGIN

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LONG TERM GOAL

We propose to develop a 3-level system of numerical models.

OBJECTIVES

We propose to build a boundary layer sedimentation model ***(Resuspension-Bioturbation*** **Model** (level 1), incorporate the Resuspension-Bioturbation Model as the 'driving element' in a 2-D, cross-shelf ***Facies Model*** (level 2), and Develop a time-averaged, cross-margin sediment transport model in which the morphodynamics of the continental margin surface is reproduced***(Sequence Stratigraphic model*** (level 3).

APPROACH

We plan to calibrate the resuspension model against the tripod data sets that have been collected in the course of the Strataform program. The Facies model must be probabilistic in design, in order to develop realizations of the storm and flood climates. Modeling at the stratigraphic scale will require control of morphodynamics and lithospheric mechanics.

WORK COMPLETED

We (Yong Zhang, ODU) have developed a simple 1-D resuspension model suitable for driving the 2-D facies model. We (Alan Niedoroda and Chris Reed, WCI) have also developed a more sophisticated 1-D resuspension-bioturbation model that fully describes boundary layer resuspensive behavior, and computes the effects of bioturbation on the adjacent sea floor. We have an operational 2-D facies model, developed by Yong Zhang (ODU) that computes storm and flood bed successions the shelf floor. We have an operational version of our stratigraphic model that combines both the LDGO Geophysical routines and The WCI sediment transport algorithm.

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RESULTS

Our Level 1 Models show a "lidding" effect in the combined flow boundary layer occurs during major storms and may have a major effect on sediment transport.
Results from the 2-D facies model (Level 2) show that the mud facies tract begins much closer to shore than it would if coastal erosion, not river flooding, were the primary source of sediment. It also shows that optimum storm bed thickness occurs on the seventy meter isobath of the Northern California Shelf. The model indicates that while most beds on the Northern California Study area are of more or less recent flood provenance, most of their material has undergone multiple resuspensions, and is storm packaged. Their sediment is in various stages of textural maturity, depending on the number of resuspensions to which it has been subjected. Muddy beds have been subjected to less storm reworking than sandy beds, but their thickness distributions are controlled by wave height, not storm intensity. Our stratigraphic model (level 3) demonstrates that continental shelf surfaces are surfaces of equilibrium, and that clinoform shelf structure reflect attempts by the shelf surface to regain equilibrium after conditions have changed rapidly.

IMPACT AND APPLICATIONS

The facies model described above will predict the geotechnical and acoustic properties of first 10 meters of the sea floor. The Stratigraphic model will predict seafloor structure at depths up to several kilometers, for foundation studies and petroleum exploration.

TRANSITIONS

We are, in structural terms, the most "downstream" component of Strataform in the sense that we use the results of other Strataform groups, but the consumers of our group will be will consist of the larger world outside of Strataform.

RELATED PROJECTS

We are calibrating the models against dynamical data sets collected by Cacchione, Sternberg, and Wright. We are validating the models by comparison with the sea floor observations of Drake, Wheatcroft, Borgeld, and Nittrouer. We are cooperating closely with ongoing Strataform modeling efforts by Syvitski and students (IAAR), and at Steckler at LDEO. We plan also to Collaborate with Wiberg (UVA).

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